

4. The truth table below shows the truth-values for the proposition

$$p \vee q \Rightarrow \neg p \vee \neg q$$

p	q	$\neg p$	$\neg q$	$p \vee q$	$\neg p \vee \neg q$	$p \vee q \Rightarrow \neg p \vee \neg q$
T	T	F	F		F	
T	F	F		T	T	T
F	T	T	F	T	T	T
F	F	T	T	F		T

- (a) Explain the distinction between the compound propositions, $p \vee q$ and $p \wedge q$.
- (b) Fill in the four missing truth-values on the table.
- (c) State whether the proposition $p \vee q \Rightarrow \neg p \vee \neg q$ is a tautology, a contradiction or neither.

Working:

Answers:

- (a) _____

- (c) _____



8. The local park is used for walking dogs. The sizes of the dogs are observed at different times of the day. The table below shows the numbers of dogs present, classified by size, at three different times last Sunday.

	Small	Medium	Large
Morning	9	18	21
Afternoon	11	6	13
Evening	7	8	9

- (a) Write a suitable null hypothesis for a χ^2 test on this data.
- (b) Write down the value of χ^2 for this data.
- (c) The number of degrees of freedom is 4. Show how this value is calculated.

The critical value, at the 5% level of significance, is 9.488.

- (d) What conclusion can be drawn from this test? Give a reason for your answer.

Working:

Answers:

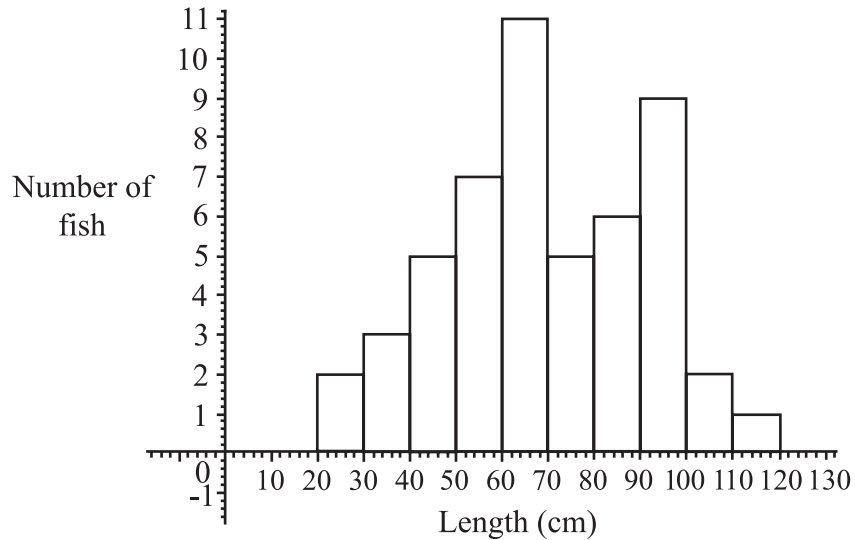
- (a) _____
- (b) _____
- (c) _____
- (d) _____
- _____
- _____
- _____



Please start each question on a new page. You are advised to show all working, where possible. Where an answer is wrong, some marks may be given for correct method, provided this is shown by written working. Solutions found from a graphic display calculator should be supported by suitable working, e.g. if graphs are used to find a solution, you should sketch these as part of your answer.

1. [Maximum mark: 14]

The figure below shows the lengths in centimetres of fish found in the net of a small trawler.



- (a) Find the total number of fish in the net. [2 marks]
- (b) Find (i) the modal length interval,
(ii) the interval containing the median length,
(iii) an estimate of the mean length. [5 marks]
- (c) (i) Write down an estimate for the standard deviation of the lengths.
(ii) How many fish (if any) have length **greater than** three standard deviations **above** the mean? [3 marks]

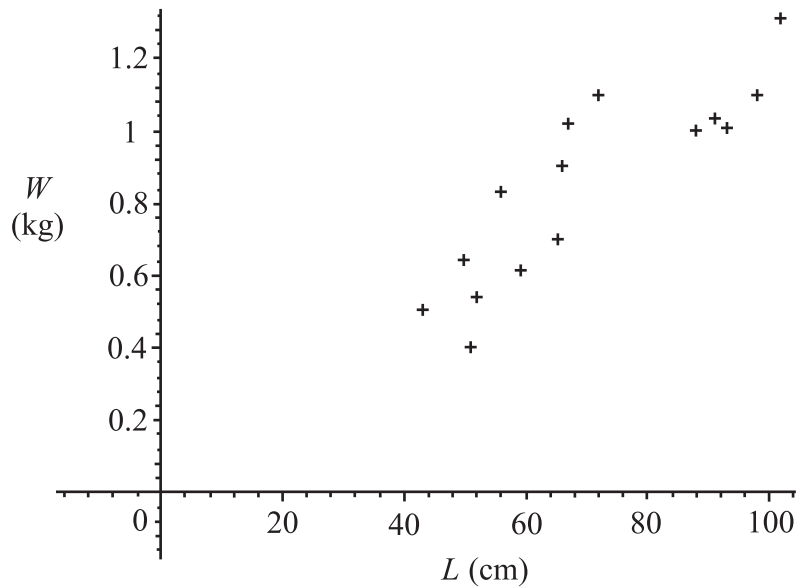
The fishing company must pay a fine if more than 10% of the catch have lengths less than 40cm.

- (d) Do a calculation to decide whether the company is fined. [2 marks]

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(Question 1 continued)

A sample of 15 of the fish was weighed. The weight, W was plotted against length, L as shown below.



- (e) Exactly **two** of the following statements about the plot could be correct. Identify the two correct statements.

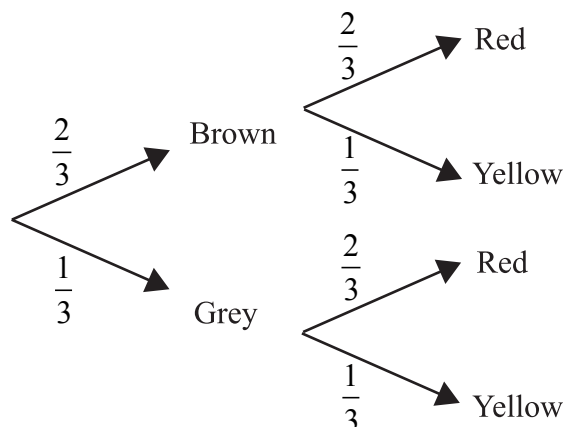
[2 marks]

Note: You do **not** need to enter data in a GDC **or** to calculate r exactly.

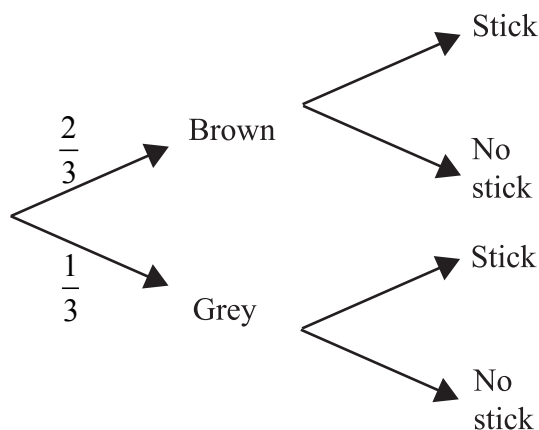
- (i) The value of r , the correlation coefficient, is approximately 0.871.
- (ii) There is an exact linear relation between W and L .
- (iii) The line of regression of W on L has equation $W = 0.012L + 0.008$.
- (iv) There is negative correlation between the length and weight.
- (v) The value of r , the correlation coefficient, is approximately 0.998.
- (vi) The line of regression of W on L has equation $W = 63.5L + 16.5$.

5. [Maximum mark: 21]

- (i) Neil has three dogs. Two are brown and one is grey. When he feeds the dogs, Neil uses three bowls and gives them out randomly. There are two red bowls and one yellow bowl. This information is shown on the tree diagram below.



- (a) One of the dogs is chosen at random.
- (i) Find P (the dog is grey and has the yellow bowl).
- (ii) Find P (the dog does not get the yellow bowl). [3 marks]
- (b) Neil often takes the dogs to the park after they have eaten. He has noticed that the grey dog plays with a stick for a quarter of the time and both brown dogs play with sticks for half of the time. This information is shown on the tree diagram below.



- (i) Copy the tree diagram and add the four missing probability values on the branches that refer to playing with a stick.

During a trip to the park, one of the dogs is chosen at random.

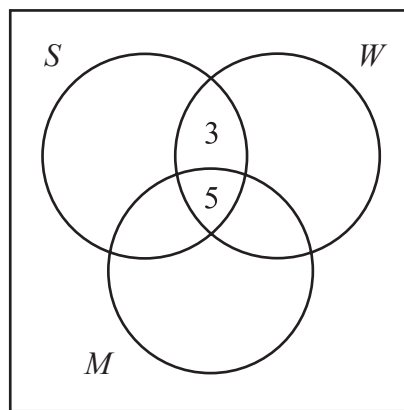
- (ii) Find P (the dog is grey or is playing with a stick, but not both).
- (iii) Find P (the dog is grey given that the dog is playing with a stick).
- (iv) Find P (the dog is grey and was fed from the yellow bowl and is not playing with a stick). [9 marks]

(This question continues on the following page)

(Question 5 continued)

- (ii) There are 49 mice in a pet shop.
- 30 mice are white.
- 27 mice are male.
- 18 mice have short tails.
- 8 mice are white and have short tails.
- 11 mice are male and have short tails.
- 7 mice are male but neither white nor short-tailed.
- 5 mice have all three characteristics and
- 2 have none.

Copy the diagram below to your examination script.



U
 W represents white mice.
 M represents male mice.
 S represents short-tailed mice.

- (a) Complete the diagram, using the information given in the question. [4 marks]
- (b) Find (i) $n(M \cap W)$
- (ii) $n(M' \cup S)$ [3 marks]

Two mice are chosen without replacement.

- (c) Find P (both mice are short-tailed). [2 marks]